# *What does "capped" mean....??*

As we continue through the summer season this year, you are bound to hear the term "capped" used during a weather forecast at one time or another. Often times this term is used to explain why thunderstorms will not develop, and why conditions will remain hot and dry. Here's an example: "*despite the hot and humid conditions, the atmosphere will remain* ***capped*** *and thunderstorms will not develop*". What exactly does "capped" mean?

It's a pretty complex phenomenon, but here's a simplified attempt to explain it. Throughout the day, the sun is able to heat up the ground, and in return heat up the air close to the ground. By late afternoon, this hot air next to the ground can become unstable, begin to rise, form a cloud, and eventually a thunderstorm. However, sometimes there is a warm layer of air that is located a few thousand feet above the ground. This elevated warm layer can prevent the hot air next to the ground from rising and forming a storm. The warm layer acts as a "lid" or "cap", which stops thunderstorm development. The end result is hot and dry conditions.

One way to view this "lid" or "cap" is to look at a sounding. A sounding is a vertical snap shot of the atmosphere. It shows how temperature and moisture change with height at a specific location. A "cap" looks like a warm nose, and is generally dry. In the sounding shown for Des Moines from Monday afternoon, this warm layer is located about 2900 ft above ground level (Fig 1). The second figure shows the temperatures at this level, roughly 900 mb, all across the Midwest. This image shows very warm temperatures all across the Corn Belt region (Fig 2).

There are a few ways that the atmosphere is able to break through the "cap". Sometimes convergence along a frontal boundary is enough to lift the surface air through the warm layer. Other times, the atmosphere can cool the warm layer and weaken the "cap". Also there are times when the surface temperatures can get so hot, that they are able to break through the "cap".

So in a nut shell, the "cap" refers to a warm layer a few thousand feet above the ground that keeps thunderstorms from forming, and allows for hot summer temperatures (Fig 3).

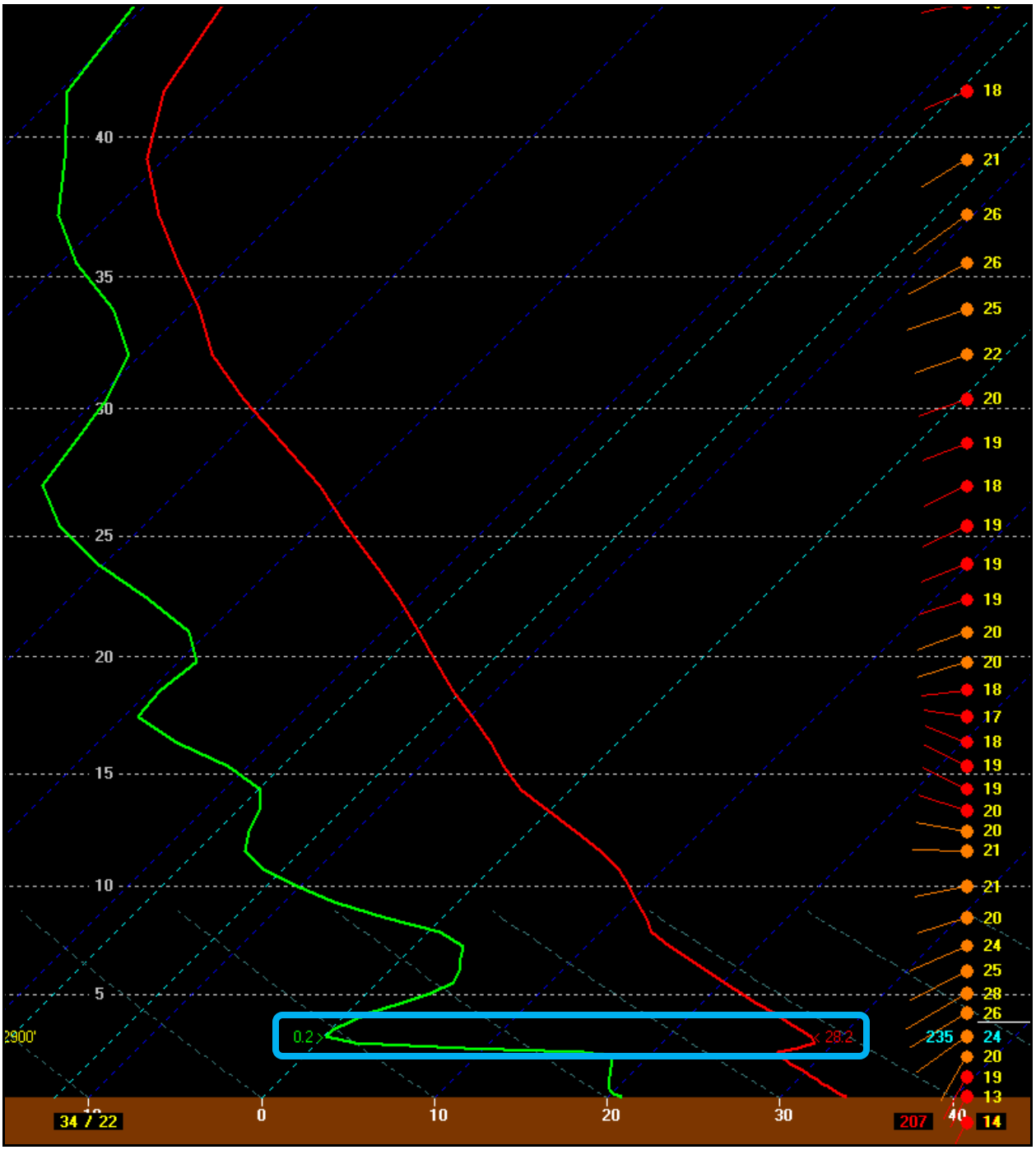


*Figure 1: The image above shows how the temperature (red) and dewpoint (green) change with height for Des Moines at 5pm on Monday afternoon. Both temperature and dewpoint are in degrees Celsius. The numbers on the left-hand side corresponding to the horizontal white dashed line are in thousands of feet above ground level. The orange and red lines on the right-hand side are the winds at different levels of the atmosphere. The "cap" is indicated by the blue rectangle. Notice that this layer is warm and dry.*

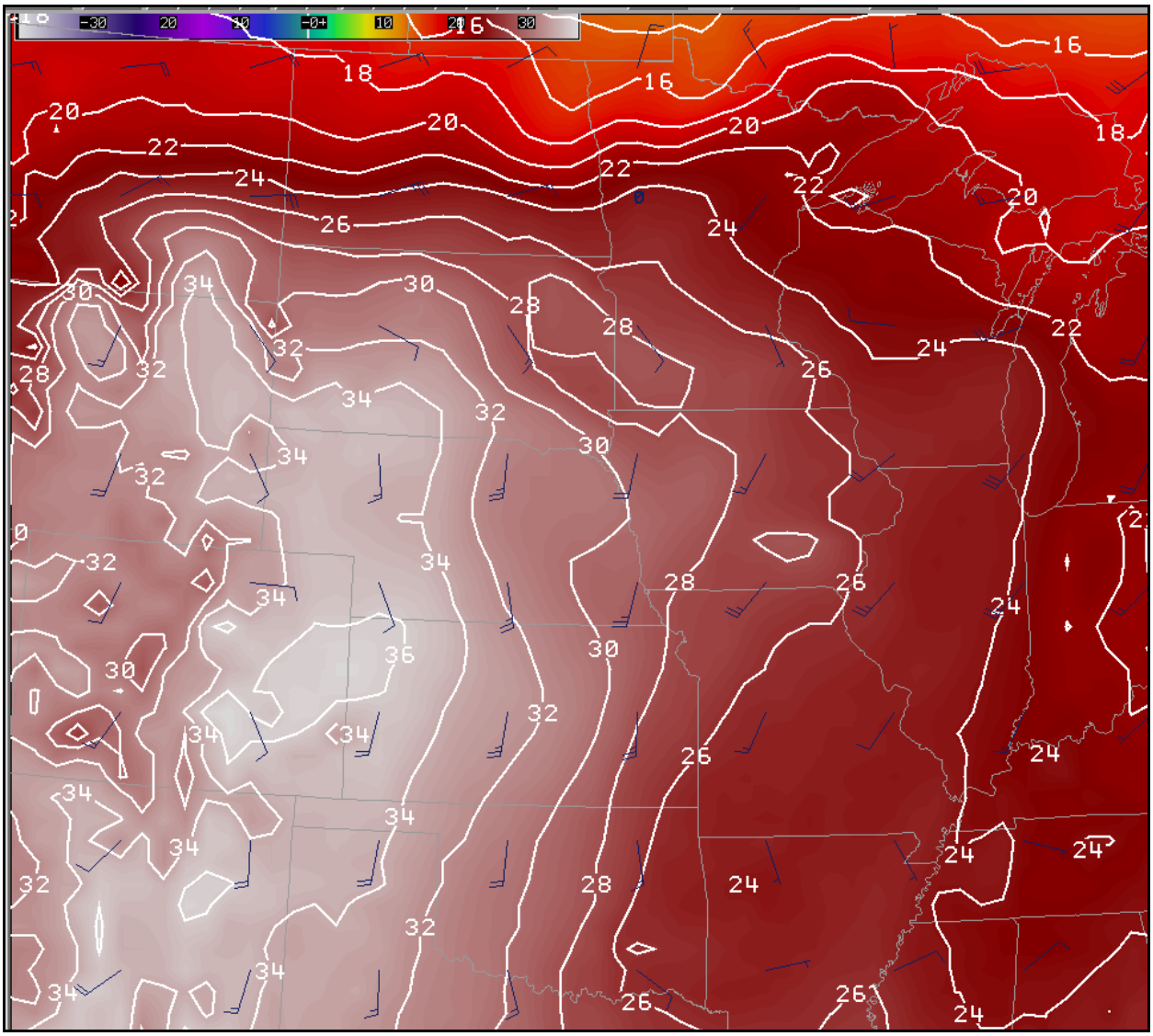


*Figure 2: This image shows temperatures (°C) at approximately the same level and time as the warm layer from the sounding. The winds are also shown. Usually the warm layer originates over the high plains out west, and gets blown across Iowa by southwesterly winds.*

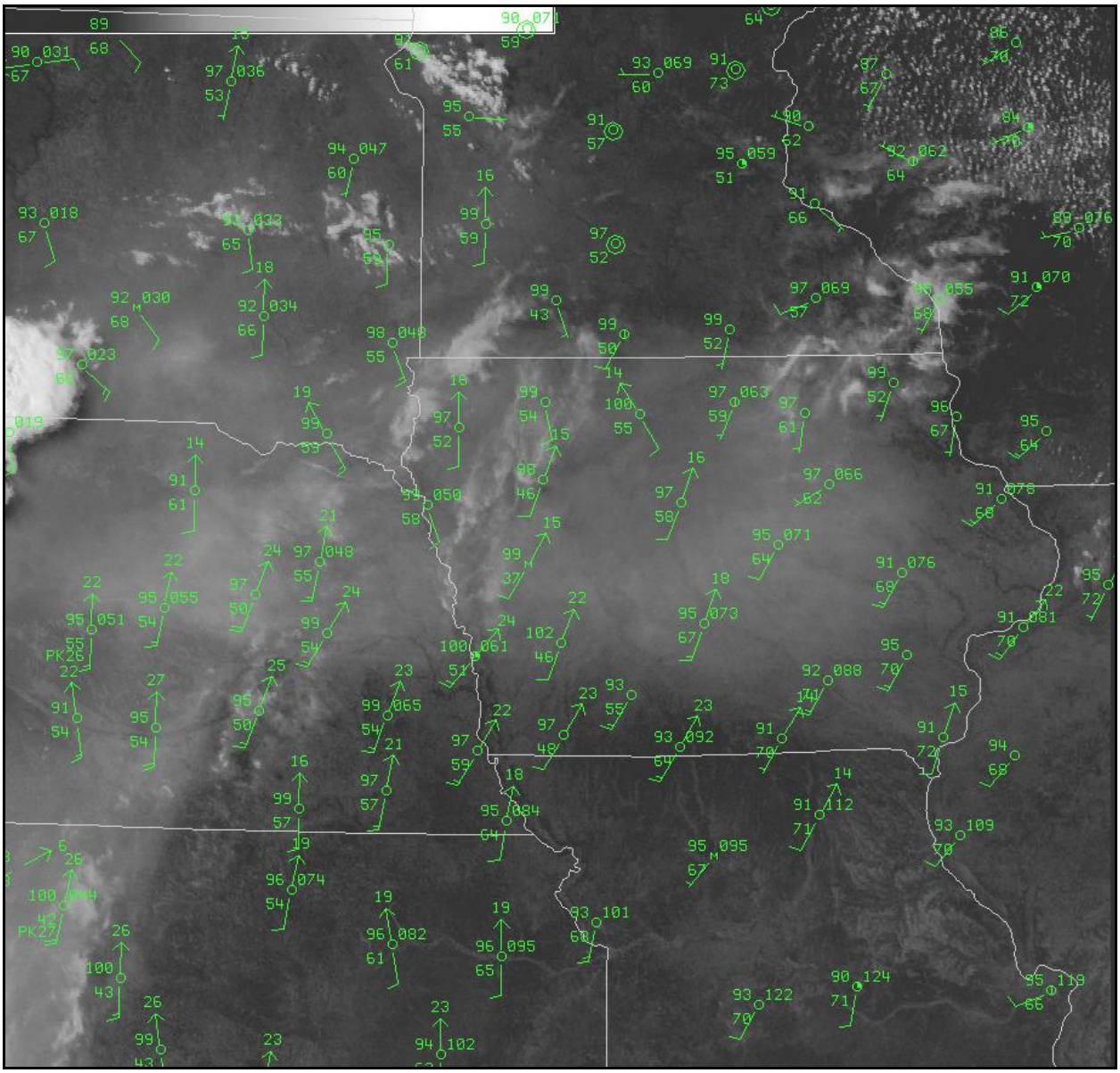

*Figure 3: The result of a "capped" atmosphere is shown in this image above. The visible satellite is overlaid with surface observations from 5pm Monday afternoon. Temperatures were in the mid to upper 90s all across the state, with some locations reaching 100 °F. Interestingly enough, the thin clouds across Iowa are actually small smoke particles from the wildfires in Arizona.*